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TYPICAL VIEW FROM THE BRINK OF THE GRAND CANON OF THE COLORADO

THE
National Geographic Magazine

VOL. VIII JULY-AUGUST, 1897 NOS. 7-8

THE VENEZUELAN BOUNDARY COMMISSION AND ITS WORK

By MARCUS BAKER

Cartographer, U. S. Geological Survey

On the northeast shoulder of South America, between the mouths of the great rivers Amazon and Orinoco, lies Guiana. On the extreme east and nearest the Amazon is French Guiana, or Cayenne; just west of this is Dutch Guiana, or Surinam, while the next division to the west is British Guiana, a colony of Great Britain; and this in turn is bordered on the west by Venezuela, one of the South American republics.

Between these last two, British Guiana and Venezuela, current maps show a boundary line which, starting at or near the southern mouth of the Orinoco (for there are many mouths in its 150-mile-wide delta), runs in a southerly direction into the interior. This line, speaking in only the most general terms, is the now famous Schomburgk line. This boundary is in dispute, and has been so for more than half a century. It has been a source of prolix and interminable diplomatic correspondence and negotiation, a correspondence couched in politest phrase, without concealing the earnestness, nay, bitterness, underneath. Proposals and counter-proposals had been made, but without success. Arbitration had been proposed, but until recently Great Britain had steadily refused to submit the entire disputed territory to arbitration. So the case dragged on for weary years. Finally, in 1886, some 10 years ago, Venezuela severed diplomatic relations with Great Britain and sent her official representative away.

Venezuela then sought to bring about indirectly, through the friendly aid of a third power, a settlement of the long standing

and irritating controversy. The matter was taken up by our own foreign office (the Department of State) and correspondence carried on in 1895 between Secretary Olney and Lord Salisbury. Secretary Olney, in a document resembling a lawyer's brief much more than it does the ordinary diplomatic dispatch, stated the case as it appeared to him and asked that it be arbitrated. To this Lord Salisbury replied in two careful and most courteous dispatches (as diplomatists are wont to call letters), declining general arbitration.

Thereupon President Cleveland, on December 17, 1895, sent to Congress this correspondence, accompanied by a brief but now famous message—a message of which, without exaggeration, it may be said that it startled the civilized world. After summarizing the correspondence and commenting upon Lord Salisbury's two replies, President Cleveland proceeded as follows:

> In the belief that the doctrine for which we contend (the Monroe doctrine) was clear and definite, that it was founded upon substantial considerations and involved our safety and welfare, that it was fully applicable to our present conditions and to the state of the world's progress, and that it was directly related to the pending controversy, and without any conviction as to the final merits of the dispute, but anxious to learn in a satisfactory and conclusive manner whether Great Britain sought, under a claim of boundary, to extend her possession of territory fairly included within her lines of ownership, this government proposed to the government of Great Britain a resort to arbitration as the proper means of settling the question, to the end that a vexatious boundary dispute between the two contestants might be determined and our exact standing and relation in respect to the controversy might be made clear.
>
> It will be seen from the correspondence herewith submitted that this proposition has been declined by the British government upon grounds which, in the circumstances, seem to me to be far from satisfactory. It is deeply disappointing that such an appeal, actuated by the most friendly feelings toward both nations directly concerned, addressed to the sense of justice and to the magnanimity of one of the great powers of the world and touching its relations to one comparatively weak and small, should have produced no better results.
>
> The course to be pursued by this government, in view of the present condition, does not appear to admit of serious doubt. Having labored faithfully for many years to induce Great Britain to submit this dispute to impartial arbitration, and having been now finally apprised of her refusal to do so, nothing remains but to accept the situation, to recognize its plain requirements and deal with it accordingly. Great Britain's present proposition has never thus far been regarded as admissible by Venezuela, though any adjustment of the boundary which that country may deem for her advantage and may enter into of her own free will cannot of course be objected to by the United States.

Assuming, however, that the attitude of Venezuela will remain unchanged, the dispute has reached such a stage as to make it now incumbent upon the United States to take measures to determine with sufficient certainty for its justification what is the true divisional line between the Republic of Venezuela and British Guiana. The inquiry to that end should of course be conducted carefully and judicially, and due weight should be given to all available evidence, records, and facts in support of the claims of both parties.

In order that such an examination should be prosecuted in a thorough and satisfactory manner, I suggest that the Congress make an adequate appropriation for the expenses of a commission, to be appointed by the Executive, who shall make the necessary investigation and report upon the matter with the least possible delay. When such report is made and accepted it will, in my opinion, be the duty of the United States to resist by every means in its power as a willful aggression upon its rights and interests the appropriation by Great Britain of any lands or the exercise of governmental jurisdiction over any territory which, after investigation, we have determined of right belongs to Venezuela.

In making these recommendations I am fully alive to the responsibilities incurred and keenly realize all the consequences that may follow.

I am nevertheless firm in my conviction that while it is a grievous thing to contemplate the two great English-speaking peoples of the world as being otherwise than friendly competitors in the onward march of civilization and strenuous and worthy rivals in all the arts of peace, there is no calamity which a great nation can invite which equals that which follows a supine submission to wrong and injustice and the consequent loss of national self-respect and honor, beneath which are shielded and defended a people's safety and greatness.

This short message went to Congress December 17, 1895, where it was read and referred to the Committee on Foreign Affairs. The following day, December 18, the chairman of that committee, the Hon. R. R. Hitt, reported a bill (H. R. 2173) appropriating $100,000 for the expenses of a commission to investigate and report upon the true divisional line between British Guiana and the Republic of Venezuela. This bill was passed by the House of Representatives forthwith and unanimously; it was then sent to the Senate. It was on the following day, the 19th of December, referred to the Committee on Foreign Relations in the Senate. The next day it was reported back, debated, and passed without amendment. The following day, December 21, it was a law, having received the signatures of the Speaker of the House, the Vice-President, and the President. Thus President Cleveland's suggestion on December 17, that a commission be created, was four days later the law of the land, and made so with an unanimity almost, if not quite, unparalleled. No vote

against it was recorded in either branch of Congress. On January 4, 1897, the commission was appointed, and consisted of five persons, viz:

Hon. David J. Brewer, one of the justices of the Supreme Court of the United States; Hon. Richard H. Alvey, Chief Justice of the Court of Appeals of the District of Columbia; Mr Frederick R. Coudert, a distinguished member of the New York bar, who had acted as counsel for the United States in the Bering Sea arbitration case; Hon. Andrew D. White, historian and diplomatist, and Dr Daniel C. Gilman, a learned geographer, president of the Johns Hopkins University. This commission organized by electing Mr Justice Brewer president and Mr Severo Mallet-Prevost, of the New York bar, as secretary.

Upon this commission were laid two duties: *first*, to investigate, and *second*, to report. Obviously investigation was first, not merely in order, but in the amount of labor involved and in importance. In the early sessions of the commission the whole subject was canvassed, and the work of investigation planned, organized, and assigned. Professor George L. Burr, of Cornell University, a painstaking and accurate historian and linguist, was sent to Holland to investigate the Dutch archives. Later on he was joined there by Mr Coudert, of the commission. For assistance in the preparation of maps and in geographical investigation, application was made to the U. S. Geological Survey. To this work I was assigned, and from January to May, 1896, gave to it such time as could be spared from Survey duties. In May, 1896, I was, however, detailed to the service of the commission, and continued to serve on this detail till the close of the commission's labors and the publication of its results in June, 1897.

When, in November, 1896, it was made known that Great Britain and Venezuela had at last come together and had agreed to submit their dispute to arbitration, the commission found itself set free from the need of pronouncing judgment. As the contending parties had themselves agreed to submit their differences to an arbitral tribunal, it was obviously for that tribunal to pronounce judgment. Moreover, as Mr Justice Brewer had been chosen as a member of the arbitral tribunal, it was obviously improper that he should pronounce judgment in advance of his sitting with that tribunal. The commission accordingly decided to withhold any conclusions it might have reached and to publish only its investigations. Thus the facts gathered have become public property. The investigations undertaken were unfinished

when arbitration was agreed upon, but the commission decided to stop short and print in as complete and systematic form as time permitted the facts then gathered.

The facts gathered by the commission are set forth in three octavo volumes and an atlas comprising 76 maps. The atlas constitutes volume 4 of the report and was the first volume completed. It is composed, as above stated, of 76 maps, divided into three groups or parts.

Part I comprises 15 maps, all printed on the same base. This base map was specially compiled and engraved for the commission, and is designed to represent the latest and best information as to the natural features of the Orinoco-Essequibo region. It is based chiefly on the so-called great map of the colony, dated 1875, and published by E. Stanford, of London, in 1877. Various other maps were also made use of in its compilation. The disputed territory along the seacoast is so differently shown on maps of high authority that a compromise seemed impossible, and accordingly two different maps of the same tract are shown side by side on the base map. Map 1 shows various boundary lines proposed or claimed, map 2 the forests and savannas, map 3 the principal drainage basins, and map 4 the geology of the region as far as known. Maps 5 to 14 are historical maps, showing European occupation at various dates from the earliest down to 1814. "These eleven historical maps," says Professor Burr, "have been prepared to illustrate my report on the evidence of Dutch official documents as to occupation and claims in the region between the Essequibo and the Orinoco, and are an attempt to show graphically the conclusions reached by that report." It may be noted in passing that if title to the disputed tract is to be determined by *occupation*, these maps showing occupation are of great significance and importance.

Part II of the atlas comprises 41 maps, facsimile reproductions of the "mother maps" of the region—produced during a period of about 300 years. Volume 3 of the commission's report contains a paper by the secretary, Mr Severo Mallet-Prevost, on the Cartographical Testimony of Geographers. The 41 maps mentioned illustrate that report and exhibit the gradual evolution of our geographical knowledge of the disputed area, and also the evolution of the various boundary lines. It constitutes an interesting and instructive group of maps and makes available for students a number of scarce ones.

Part III comprises 20 maps of an official or semi-official character, of which 12 are from manuscript originals not hitherto published. The origin of these maps, their character and meaning are set forth by Professor Burr in a paper in volume 3.

In describing the atlas, we have in part anticipated the description of volume 3, which is devoted to geography. It is an octavo volume of 517 pages and contains 6 papers. The first is by the secretary of the commission on the cartographical testimony of geographers. In its 80 pages the historical evolution of lines showing territorial division are worked out with great care, and the size of the paper inadequately measures the labor needful to gather and arrange and clearly set forth and discuss the facts therein contained.

The second paper is by Dr Justin Winsor, librarian of Harvard College, and it deals with the same topics as the preceding paper, but in a different manner. This paper was submitted to the commission very early, its date being March 4, 1896, just two months after the commission was appointed. The third and fourth papers are by Professor Burr.

The fifth paper, entitled Notes on the Geography of the Orinoco-Essequibo Region, South America, is by the present writer. It consists of a prosaic compilation of statements made by various travelers and explorers in the region as to its geography, with references, in foot-notes, to the sources of these statements. All the geographic names found applied in the region, whether now in use or not, were recorded in these notes, which are fully indexed. Thus it is possible to proceed quickly by means of the index and foot-notes to the original sources of geographic information touching any part of the country described in these notes.

The last paper in the volume is a partial list of maps of the region, also prepared by the writer. It was hoped to make an exhaustive list, but time did not suffice for this, nor for the preparation of a bibliography of the region.

Volume 2 is given mainly to extracts from Dutch archives. There are 353 of these extracts, comprising 662 pages. They are printed in double columns, the original Dutch forming one column and the English translation the parallel column. Some miscellaneous manuscript documents, filed with the commission by the government of Venezuela, close the volume.

Volume 1, first in order but last to be published, is now in press and will shortly be published. It is to contain the report

of the commission, which, however, is not new to the world, having been published May 25, 1897, as Senate Document No. 106, 55th Congress, 1st session. It is to contain also a report by Professor J. F. Jameson, of Brown University, on the Treaty of Münster of 1648, and also Professor Burr's report upon what he found in the Dutch archives bearing upon the boundary matter. Exact reproductions of those Dutch documents with translations constitute the major part of volume 2. Professor Burr's report, however, will tell a connected story of Dutch occupation and doings in the disputed territory, as gathered from these old manuscript chronicles of the Dutch.

With the publication in the summer of 1897 of these four volumes the labors of the Venezuelan Boundary Commission end. The controversy, however, is not ended, but its settlement has been relegated to a new tribunal—a tribunal of arbitration, to be composed of five of the world's leading jurists.

The commission, whose work now ends, it will be remembered, is wholly a United States commission. The United States devised it, created it, and maintained it; and it did this "to determine with sufficient certainty, for its own justification, what is the true boundary line between British Guiana and Venezuela." It is a high compliment to the character of the commission that both Great Britain and Venezuela promptly and cordially aided it to the fullest extent by furnishing information fully and freely. Neither was bound so to do, and neither had agreed to accept its conclusions. But as time progressed it became clear that this quasi or involuntary arbitration, if I may say so, might well be turned into an actual arbitration—an arbitration where all the facts could be sifted out, judicially weighed, and a just conclusion reached. Accordingly, at the Lord Mayor's banquet in London last November, Lord Salisbury announced that an agreement had been reached by which the long-drawn-out controversy was on its way to a peaceful, amicable, just, and final determination; an agreement to arbitrate had been reached.

That the action taken by the United States some eleven months before was a powerful agency toward securing this much-to-be-desired end does not admit of doubt. Such is the prevailing opinion. Such is the opinion of the commission itself, which in its report says: "A wise and just view of the case is that the commission has been a potent factor in bringing the two nations into a consent to submit the matter in dispute to an arbitral tribunal."

In addition to the influence exerted by the commission in initiating the peaceful settlement of the dispute, the contribution which it has made to the scholars of the world should not be overlooked. The investigations in history and geography set forth in the papers accompanying its report have a value wholly apart from the case to which they owe their origin.

A few words about the arbitral tribunal and the work before it must end this already too long article.

On February 2, 1897, a treaty of arbitration as to the boundary was signed in Washington by Señor José Andrade, for Venezuela, and by Sir Julian Pauncefote, for Great Britain. It consists of 14 articles, describing in precise legal and formal phraseology how the dispute is to be disposed of. A printed copy of that now public treaty lies before me as I write. Let me summarize it.

First. An arbitral tribunal is to be named forthwith.

Second. It is to be composed of five jurists, two named by Venezuela and two by Great Britain. Venezuela names Chief Justice Fuller and Mr Justice Brewer, of the United States Supreme Court, and Great Britain names Baron Herschell and Sir Richard H. Collins, of Her Majesty's privy council. These four are to select, on or before September 14, 1897, a fifth arbiter, a jurist, who is to be president of the tribunal. In the event of failure to do so, the fifth arbiter is to be chosen by the King of Sweden.

Third. The tribunal is to determine what belonged to the Netherlands and what to Spain at the time when Great Britain acquired from the Dutch what is now British Guiana.

Fourth. The tribunal shall take account of all pertinent facts, shall be governed by the principles of international law, and by three rules, viz:

(*a*) Adverse possession or prescription for 50 years to constitute a good title.

(*b*) The arbitrators may recognize and give effect to laws supported on any other valid foundation (than adverse possession) and which conform to international law.

(*c*) In determining the boundary, if the tribunal shall find that the territory of one party was at the date of this treaty occupied by citizens or subjects of the other, it shall give to such occupation the effect which in its opinion is required by reason, justice, the principles of international law, and the equities of the case.

Fifth. The arbiters are to meet in Paris within 60 days after the printed arguments have been submitted, and decide the questions submitted; all questions to be decided by a majority; each party to appoint an agent to assist the tribunal.

Sixth. Within eight months, *i. e.*, on or before February 14, 1898, the case is to be submitted, with proofs, documents, etc.

Seventh. Within four months thereafter, *i. e.*, on or before June 14, 1898, the counter-case is to be similarly submitted, and may contain new matter, with proofs.

Eighth. Within three months thereafter, *i. e.*, on or before September 14, 1898, the agent of each government must submit his argument in print. Oral arguments may then be had.

Ninth. The arbiters may lengthen each period above named by 30 days.

Tenth. Decision to be rendered within three months after the case has been argued, to be in duplicate, in writing, and signed by the arbiters who assent to it.

Eleventh. An exact journal of proceedings is to be kept.

Twelfth. Each government is to pay its own agent, and the cost of the arbitration shared equally.

Thirteenth. The parties agree to be bound by the decisions rendered.

It thus appears that the controversy bids fair to reach its final stage sometime during the winter of 1898–'99.

MINERAL PRODUCTION IN THE UNITED STATES

The mineral products of the United States in the calendar year 1896 had a total value, according to a recent report of the U. S. Geological Survey, of $621,969,943, the value of the metallic products being more by $4,868,931, and that of the non-metallic less by $5,586,656, than in 1895.

The great increase in the production of pig iron, so much commented upon last year, has not been maintained, the output having fallen off more than 800,000 long tons, representing a decrease in value of nearly $15,000,000. On the other hand, the production of gold has increased from $46,610,000 to $53,088,000, that of silver from $36,445,000 to $39,655,000, and that of copper from $38,682,347 to $48,698,267. Gold shows an increase of over 60 per cent in four years, the production of silver is the largest since 1893, and even the output of copper has almost doubled

since 1889. The most remarkable increase, however, is that of aluminum, the production of which has increased from 18,000 pounds, worth $59,000, in 1887, to 1,300,000 pounds, valued at $520,000, in 1896, the value per pound having fallen, as will be perceived, from $3.28 to 40 cents within the period named.

To return to a comparison of the statistics of 1896 and 1895, an increase in the production of bituminous coal from 135,118,193 to 137,640,276 short tons has been accompanied by a sufficient decline in prices to reduce the total value of the output from $115,749,771 to $114,891,515. On the other hand, a considerably smaller production of Pennsylvania anthracite has represented almost as great a value in the market as the output of the previous year. The production of building stone has been the smallest in point of value (quantities not being reported) since 1888, but the estimated production of brick clay is still represented by the same round figures, $9,000,000, that have done duty for the last half-dozen years.

There appears to have been a considerable increase (nearly 4,000,000 gallons, or over 18 per cent) in the sale of mineral waters. It would be interesting to know how far this remarkable increase is due to the use of non-medicinal mineral waters for table purposes, and how far it is to be attributed to the apparently largely increased use of lithia water as a remedy for certain bodily ailments that seem to be peculiarly characteristic of our time. Of the remaining principal products reported upon, petroleum reaches, in 60,960,361 barrels, the highest figures its production has ever attained; salt shows a slight increase in production, with a considerable decrease in value, and the production of borax—no less than 13,508,000 pounds—is the largest on record, with the single exception of that of 1894. J. H.

THE FORESTS AND DESERTS OF ARIZONA*

By BERNHARD E. FERNOW, Ph.D., LL.D., etc.,

Chief of the Division of Forestry, U. S. Department of Agriculture

It is a notable fact that but few of our people have any adequate conception of the vastness and the varied conditions of their country, and still less do they realize its opportunities for future growth. The horizon of the majority, even of those who have made hasty overland trips, rarely reaches beyond the limits of their personal observation, and as to the possibilities of the future—even those who have studied our past development fail to realize them. Our imagination—save in the professional boomer—lags behind reasonable expectation.

When I told my friends that a happy accident—the invitation of a generous and public-spirited friend—would take me for the summer months to and through Arizona, two expressions were most frequent: one of commiseration at my prospects of summer temperatures, the other a somewhat astonished inquiry as to what a forester could find of interest in that country of cactus and desert. That a large part of the territory of Arizona can boast of an ideal summer climate, unequaled for camping, was a revelation to them; and that some of the most interesting mountain forests—botanically speaking—are to be found there, and the most lovely and most extensive, as well as most economically important pineries that exist between the great forests of the Pacific coast and the western border of the Atlantic forest in Texas and Arkansas, a thousand miles away in either direction—this seemed to them almost incredible.

Why should this particular forest area become a subject of investigation? The question is worthy of answer. Here is a territory still undeveloped, still undespoiled for the larger part—a territory needing for its best future development not only the material which these forest areas can furnish forever, but dependent on irrigation for its agricultural future, and thus requiring that protection of its water sources which a forest cover is supposed to afford. Would it not be wisdom to study the relation of this resource to the whole development of the country, and

*An address delivered before the National Geographic Society, February 5, 1897

to study the conditions under which this resource could be rationally managed, so as to avoid as far as practicable the devastation that has characterized our occupation of other sections, and thus pave the way for a rational use of this important, yet limited, resource? To be sure, this is hardly the way we are wont to do, for with regard to our resources, especially our forests, we take a position somewhat similar to that of the old gentleman from Arkansas: "When it was raining he could not mend his roof, and when it was not he did not need a roof anyway."

Arizona, the unknown and maligned; the land of thorns and spines; the province of apparently hopeless deserts and yet of rich promise; the land of dreary wastes and yet of infinite variety and contrasts; the territory most picturesque and full of interest to the geologist and botanist and ethnologist, even to the mere sightseer, and yet the least visited; the earliest discovered of the western territories and yet the last to pass from the redman's dominion and the least developed; the land of a high prehistoric civilization, of cave-dwellers and cliff-dwellers, and of the peaceful agricultural Hopi and Pima, and yet until a decade ago terrorized by the most warlike of the Indians, the Apache—Arizona is one of the most interesting of all our provinces.

It is curious that the health-inspiring, rejuvenating quality of Arizona's dry air did not impress itself upon the Spanish seekers after the Fount of Eternal Youth, one of whom was destined, while balked in his search for the latter, to first set foot on this part of the continent. Alva Nuñez Cabeza de Vaca, with two Spaniards and one Negro as companions, all four fugitives by land from slavery among the Seminole Indians in Florida and finding their way across the continent, were the first to see the "Seven Cities of Cibola," the Hopi villages; were the first to pass under the shadows of San Francisco mountain and to share the hospitalities of the Pima Indians just 360 years ago. Three years later (in 1540) an exploring expedition under Vasquez de Coronado visited the same country, and it was then that one of his lieutenants, Don Garcia Lopez de Cardenas, gazed—the first white man—on the wonders of the Grand Cañon of the Colorado. Forty years later another of the conquistadors, Antonio de Espejo, ventured forth and claimed and named the country for Spain, Nuevo Mexico, under which name it came to the United States; the portion north of Gila river by the treaty of Guadalupe Hidalgo in 1848, the portion south of the Gila by the treaty

and purchase negotiated by the then Minister to Mexico, James Gadsden, in 1854, for the purpose of obtaining a suitable route for a southern Pacific railroad, the price paid for the latter portion being $10,000,000.

Spanish development was confined entirely to the lower portions, and consisted mainly in the establishment of missions to convert the agricultural Indians, and in the location of presidios at Tucson and Tubac to protect the missions and the few haciendas and silver mines then worked, the hostile Apache constantly harassing their Indian and Spanish neighbors alike and withstanding the progress of civilization.

In 1863 the territory of Arizona was segregated from New Mexico, the name probably being a modification of Arizonac, a Papago Indian name of uncertain meaning which had been applied to a native village and was extended to the lower portion of what is now our southwestern province by the Spaniards.

The expeditions of the War Department under Sitgreaves, Williamson, Whipple, Parke, Gray, Beale, and Ives during the years from 1852 to 1860 give us the first definite knowledge of the country. Almost simultaneously with these, immigration and mining development began under protection of military forts Buchanan and Breckinridge.

From 1863, when the territory was segregated from New Mexico, to 1874, the history of Arizona is written in blood. It took a hardy man to run the risk of tomahawk and scalping-knife in order to benefit from the rich mineral discoveries in southern and middle Arizona. Nor were the mining communities themselves without their internal strife and shotgun administration of desperadoes and Mexican laborers. The successful campaigns of General Custer, however, broke the war spirit of the Indians and led to the treaty of 1874, when these Indians were placed on reservations. The advent of the Southern Pacific railroad in 1878 stimulated anew the development of the mining districts, and since the Apache Indians, with their cunning leader, Geronimo, were removed to Florida in 1886 the peaceful progress of the territory is assured, and one may travel through the country with no more fear of a hold-up than in Texas or New York.

Three centuries and three score years of history! Yet the beginnings of civilization and of the development of the territory date back hardly a score of years, and it is only a little over a decade since a really peaceful progress has begun—since the marauding Apache has been removed!

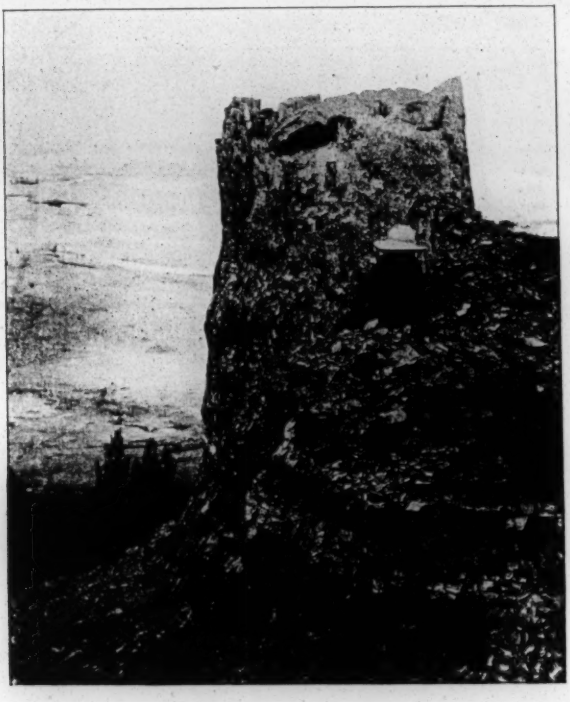
Arizona, with an area of about 114,000 square miles, equaling the combined areas of New York and the New England states, or of Ohio, Indiana, and Illinois, is in the main a plateau rising from the southwestern corner toward the north and east. From an altitude of not more than 40 feet above sea-level, at or near Yuma, the plateau level rises to 7,000 feet or more, and, with the many mountain ranges that overtop the plateau, every altitude is found up to 12,800 feet in the rude stone monument erected by Mr Gilbert on the highest peak of San Francisco mountains. There is, however, a convenient and significant altitudinal subdivision of the plateau to be noted, by which the northeastern section, with about one-third of the territory, is segregated as the Colorado plateau—a part of the great plateau which extends northward, with an average elevation of over 4,000 feet, the southwestern two-thirds forming a lower plateau, with an average elevation of probably over 1,000 feet, studded with rugged sierras which sometimes reach up nearly 10,000 feet. The division between these sections is sharp and sudden; in most parts it is a line of cliffs and steep slopes, varying from 600 to 1,200 feet and more in height, which form a rim to the higher plateau, popularly known among the Mexicans as the Mogollon and among Americans as "the rim." This great escarpment forms so abrupt a boundary line that a stone may be hurled from one region into the other. Immediately below this rim there is a climatically and botanically intermediary region or transition zone which only accentuates the two main divisions.

The convenience of this subdivision extends beyond topographic distinction, for the two sections differentiate climatically almost as abruptly as the surface, giving rise, from the standpoint of the visitor, to a summer section and a winter section, with corresponding differences in flora, fauna, and economic conditions. Thus the range of summer and winter climate which a latitudinal difference of a thousand miles effects from Maine to Florida is here effected approximately by altitudinal differences within a hundred miles.

Furthermore, the two sections are best reached, and until a few years ago could only be approached, by rail on two independent railroad systems—the Southern Pacific affording passage through the southern section and the Atlantic and Pacific (now part of the Santa Fé system) traversing the northern section. At present there is a connection between the two trunk lines by way of Phœnix and Prescott, giving access to the central

section. These three lines, with a few short feeders, comprise the entire railroad system of the territory.

The tourist starting for Arizona in July will probably enter the territory by the northern route and spend the warm months on the plateau, making Flagstaff his headquarters or base of supplies. After the hot and dreary ride over the featureless plains of western Kansas and eastern Colorado and through the hardly less dreary though more varied mountain scenery of New



PETRIFIED STUMP, ARIZONA

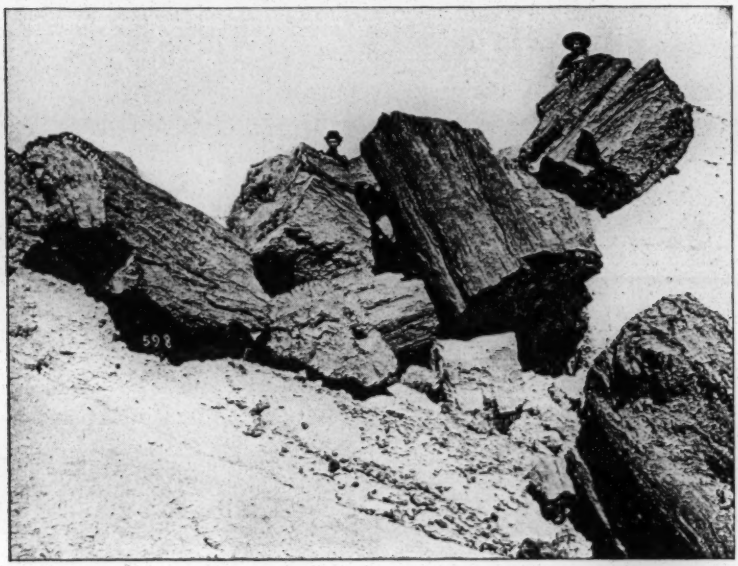
Mexico, and after passing through the desert country of the eastern border county of Arizona (containing the celebrated petrified forests, strewn in huge logs over the sandy waste), it is a relief when suddenly the piñon and juniper appear in dense masses, and finally the pine forest is entered within an hour of reaching Flagstaff. To add to the feeling of comfort and new interest which this unexpected forest scene creates, the grand peaks of the San Francisco mountains come in sight, possibly with a white veil of freshly fallen snow that vanishes before the day is over.

Then when the heavy up-grade puffing of the engine and the rumbling of the cars cease and we alight at the terminus of the railroad journey and the beginning of our camping tour in the oddly-named town, Flagstaff, in the midst of this lovely pinery, we feel at home at once, without any misgivings as to the comfort or interest of the expedition.

Coming to study the forests, we are naturally attracted by the chimneys and lumber piles in the distance, which suggest what becomes of the grand pines that we have just learned to admire. Although the sun is low—the train arriving late in the afternoon—the sawmills, which, with the cattle and sheep interests, form the *raison d'être* of the little settlement of 1,500 people, call for immediate inspection. At the mills and offices we learn that of the 24,000,000 feet of lumber now cut in the territory annually, the various sawmills of Flagstaff, supplied by a logging road of 20 miles, produce about one-half, besides some 200,000 railroad ties, supplying the local demands of the northern part of the territory and also of southern California and New Mexico. We learn from inspection of the yards that the pine lumber of the pine (*Pinus ponderosa*) is only of medium quality, yet good enough for all local uses. With a lumberman's eye we have noticed that the trees cannot yield much clear timber, and this impression is verified by the books of the sawmill men, which show that not more than 6 to 7 per cent of the logs reaching the mill yield first-class material; and we have also noted that the cut per acre must be far below what eastern lumbermen would expect. These conditions are fully realized in Flagstaff. The opinion of the president of the Arizona Lumber Company, conveyed to the governor of the territory and printed by him in his report for 1893, is suggestive:

> I believe that it is the duty of every person who can give the matter thought and who is in position to influence any one's action in the premises, to make some endeavor to perpetuate our forest conditions for the benefit of future generations in the territory. Upon the rational use of our forests will depend the happiness and welfare, and I may say the absolute existence, of any *large* population in this territory; and the time to act is the present, when the least possible injury will be done to vested rights.
>
> I believe the government ought to withdraw all timber lands it possesses and ought to appoint a competent forester who would make it his sole duty to see that the covering which nature has afforded our mountain tops should be preserved, to the end that the valley land of the territory be protected either from droughts or floods in the years to come.

The next morning we are naturally eager to start out early to climb that magnificent mountain which rises north of the little hamlet in solitary grandeur, a huge volcano whose fires have but recently been extinguished, now unique in its symmetrical and striking outlines, the most impressive feature in the landscape. The elevation of Flagstaff being about 7,000 feet, a steady ascent is made from the town for ten or twelve miles to the foot of the cone at 8,000 feet, and then comes a steeper climb. The road is through a lovely forest of bull pine (*Pinus ponderosa*), a



PETRIFIED LOGS, ARIZONA

species common from British Columbia southward, both along the Sierra Madre and the Rocky mountains, down to Mexico. The forest is open and parklike, the trees standing in groups, with here and there an old stager which was a good-sized sapling when the first white conquistadors passed through this wilderness 360 years ago. The open stand of the stately pines rearing their heads 100 and more feet into the remarkably blue sky naturally causes the formation of a long and rather symmetrical crown which adds to the scenic beauty, but not to the commercial value of the timber. Since the rainy season has not yet set in, there is but little grass and lower vegetation visible; hardly any undergrowth impedes the view; yet here and there a

clump of the scrubby Rocky mountain white-oak (*Quercus gambelii*) forms a pleasing contrast.

As we reach an altitude of 9,000 feet a change of scene occurs; the yellow-green, heavy-foliaged bull pine is supplanted by the graceful, dark-green white pine of the Rockies (*Pinus flexilis*) and the still more striking Douglas spruce, which in scattered individuals studs the now really grassy slope, for at this higher altitude more moisture and less evaporation favor the grassy growth. One thousand feet higher and we reach the region of the Foxtail pine (*P. aristata*), well named, for the long, flexible branchlets closely beset at their ends with crowded needles exhibit strikingly the appearance of a fox's tail. As we ascend, the Engelmann spruce, as widely distributed over the west as the bull pine, joins these trees and with them forms a more or less dense forest, the trunks short and much branched and gnarly, of little or no economic value. Here we find also in a few individuals a beautiful fir, a new accession to our flora, which Dr Merriam has this summer described as the Arizona cork fir (*Abies arizonica*) from specimens gathered on this very trip from this very tree. At 11,500 feet the last Engelmann spruce, tousled and shorn by the wintry blasts at this high elevation, and low creeping junipers, denote timber line. Toward the northeast we look down into what was once an enormous volcano, one side blown out; the three peaks are still above us.

A short climb of a thousand feet more over large blocks of lava or gravelly detritus brings us to the top of Humphrey's peak. From here the eye sweeps over a goodly portion of the northern part of the territory, and the vast expanse of the pine land can be traced. Toward the north stretches the Coconino forest, flanking the Grand Cañon, whose sheer walls on the opposite side are dimly discerned. Eastward and northeastward the color of the clouds indicates the position of the Painted desert, separated from the San Francisco forest by a fringe of junipers and piñons at the levels between 6,000 and 7,000 feet; toward the south and southeast, far as the eye can imagine sight—to the Mogollon and White mountains—and westward beyond the three-peaked landmark of Bill Williams mountain and Mount Sitgreaves, stretches the sea of pines, covering altogether an area of not less than 3,000 square miles.

It is proper that we should give full consideration to San Francisco mountains, for not only are they among the most picturesque and interesting to the sightseer, geologist, and plant geographer,

but they are of importance economically; not merely for the pasturage that might be gleaned from their slopes, or for their timber (which on the higher levels is not worth the cutting), but for their meteorological effect, which is increased by the forest cover. Their peaks arrest and precipitate the clouds, which would otherwise pass over the plateau and find no cause for precipitation over the eastward desert. Nu-va-ti-ky-ōbi (Home of the High Snows) is the name the Indians give to them. They form the only elevation in Arizona on which snows can and do accumulate, giving up their stores in spring, furnishing supplies for many springs and washes and to at least one perennial stream—Oak creek. From this consideration it would be proper to make into a forest reservation all the area above the level of 8,500 feet.

We may take our descent on the western face of the mountain, passing one of the loveliest spots where a never-failing spring of cold delicious water invites us to camp among the aspen growth which intermingles with the spruces and white pines; and we may also extend our excursion to pay a brief visit to Walker lake or to Crater lake, whose yawning mouth, once spouting molten masses, is now sealed by a sheet of water, a welcome find to the cattle herds roaming over the plateau to pick the sometimes scanty herbage.

Water even on the plateau is the one deficiency of the whole territory; not that there is not sufficient and even too much at times, but in its distribution it is uncertain and extreme, both by localities and by seasons, and even within the rainy season the dry air makes constant and excessive demands.

Here, as in the southern portion of Arizona, there are two wet seasons, winter and summer. On the plateau, after the beautiful days of Indian summer in November, winter begins with Christmas. While mostly clear and calm, with temperatures rarely below 22° at night, ranging to 50° or 60° in the day, snows come every ten to fourteen days to a depth of 4 to 24 inches, drifting badly, but rarely lying long, except on the higher levels, and even the frozen ground becomes soft in the middle of the day. Spring begins about the middle of April and is the dry season—windy, dusty, the first half cooler, the last half warmer, than one would wish. With the first week of July the rainy season sets in, lasting until September. With it comes the profusion of flowers which is characteristic of the Rocky mountains, and which by and by will fill the pine woods below with gay beauty and luxuriance. Whole fields of the blue flag (*Iris versicolor*)

bloom; there are magnificent carmine *Gilias* and *Pentstemons*, the dark purple and golden *Primula parryi*, the yellow columbine, and a host of others changing off through the season and making this plateau a veritable flower-garden.

The rains hardly ever come as land rains, but their nature and quantity are very variable. A short shower each afternoon is said to be the regulation rain, but the season of 1895 excelled in terrific downpours, with most boisterous thundering and brilliant lightning, not even respecting the nightly rest of the tentless camper. Yet the dry air soon obliterates the dampness. The temperature, however, is kept at a most delightful, uniform degree, never much above 75° or 80°, and the sunsets after a late thunderstorm are the most gorgeous to be seen anywhere. The nights are cool, toward morning occasionally even cold. Altogether the summer climate in the pines is ideal.

While preparing for our trip of exploration there are many points of interest around Flagstaff to visit. We may descend into Cosnino or Walnut cañon, a deep, narrow cut, with its long rows of cliff-dwellings built into the limestone walls reminding us of bygone millenniums, when a teeming population must have lived here. These dry ridges and plateau portions are wooded with the low trees, rarely over 30 feet high, often shrublike in form, of the piñon or nut pine (*Pinus edulis*), whose sweet seeds are gathered for food by the Indians, and the western juniper (*Juniperus utahensis*), fit only for firewood, interspersed with shrubs of striking form and foliage, almost always spiny and of peculiar interest. Among these are the pink-flowered locust, the yellow-flowered, prickly-leafed barberry, the fruit making excellent jam, the trifoliate, red-fruited squawberry, of delicious acid taste, and the snowy, white-tufted cliff rose, which is not a rose at all, yet fills the air with a rare fragrance.

An inspection of the logging operations gives an opportunity to make measurements of the rate of growth of the pines and to observe the differences in their development, giving rise to the lumberman's classification into jack pines, the younger or quickly grown, and yellow pines, the older or slowly grown, which are from 250 to 300 years and more old.

Presently we start southward, looking back on the hospitable town of Flagstaff and its grand mountain and forest entourage, across the waste which the logger and the unavoidable forest fire have made, and the natural prairie or glade south of it. Such glades, from a few acres to several square miles in extent, are

a very general and interesting phenomenon throughout these woods, furnishing not only most pleasing vistas but opportunity for pasturage and agricultural use. Their soil is usually rich black loam washed from the surrounding hills, rather compact and liable to a wide range of moisture conditions on account of deficient drainage, and hence inimical to tree-growth, but readily supporting a greensward of grass. In wet seasons these depressions sometimes turn into lakes. Mormon lake, which we pass, is such a prairie, some five miles long and one to two miles wide, which, when the Mormons arrived there, had the appearance of a rich meadow, inducing them to settle and go into dairy farming; after a few years the glade filled up with water and became a lake; in 1895 it was all dry except a small remnant of water in the lowest depression. As these patches of fertile land, forming about 15 to 20 per cent of the forested area, are destined to become objects of agricultural development—they have begun to be so used—and in that way to be helpful in the rational management of the surrounding forest country, it would be of interest to experiment as to their best treatment; many of them by judicious ditching, by which the moisture extremes may be abated, can undoubtedly be made to produce various crops besides the potato and alfalfa or oats which the short season and the cold condition of the soil now permit.

As we proceed we presently pass a most forbidding spot, where the limestone soil is covered with black blocks of lava, giving rise to soils locally known as malapai, corrupted from the Spanish *mal pais*, bad lands, although the soil is not so bad after all, at least for tree-growth. One of the great lava fields of the world, made up of basalt and trachyte, extends from San Francisco mountains southward and northward, covering fully 20,000 square miles with its overflow.

As we progress through the forest we learn from the differences of soils and consequent differences in development of the trees something of the geology of this plateau. Archæan, Silurian, Carboniferous, Juratrias, Cretaceous, and igneous rocks are found. Three soil formations are readily recognized—limestone here, sandstone there, and over both, irregularly, the decomposed beds of lava which have overflowed thousands of square miles, giving rise to the malapai. So far as tree-growth is concerned, wherever the decomposition of the lava blocks has been thorough and limestones have added their quota, the soil is by no means unfavorable. The limestone soils seem to produce the best timber, the sandstone soils the poorest.

Water is to be found in springs only at rare intervals, and hence camping places must be known; yet the few wells which have been dug here and there, furnishing deliciously cool and good water, suggest that the development of water resources could be extended.

As we become familiar with the woods and observe how the trees always stand in groups with open spaces between, and how the young growths, from the seedling to the sapling, also occur only in groups and patches; and as we lie in our tentless bed in an open spot, where neither cones nor caterpillars can drop on us, and ponder over the reasons for this aspect of tree distribution, we come to the conclusion that water conditions or soil conditions affected by drainage must account for it. Those portions of the rocky and unevenly disintegrated soil which permit a temporary storage of sufficient moisture at the proper season will alone reproduce and permit the young growth to thrive. Another interesting observation regarding these pine forests is that young growth seems to appear only in irregular periods, from three to ten years intervening between the groups of young trees. After a fortnight's progress of the rainy season, millions of little seedlings spring up all through the wood, carrying their seed shells in characteristic manner above ground, a rich promise of a dense, young aftergrowth, yet probably all doomed to perish from frost, because the short season does not permit the ripening of their wood. The reproduction, to be permanent, must take place in the spring, induced by a wet winter and spring season, which occurs only at considerable intervals.

The farther south we progress on our journey the denser, statelier, and more valuable grows the pine forest, undisturbed as yet by the hand of man. Presently we emerge from its shady recesses, and as we pass the last pines a candelabrum of flaming red and yellow lights—a century plant in bloom, messenger of warmer climes, that has found its way up along a cañon from the lower levels—tells us that soon we shall be in the region of cactus, yucca, and catsclaw.

If we had time we would visit those picturesque red rocks which loom up in the west, forming the cañons of Oak creek, the perennial daughter of San Francisco mountains, the clearest mountain stream in this entire region, in its upper part famed for beautiful trout pools. In its middle part, hardly known to even the nearest neighbors and not at all to the outside world, it affords the most romantic and most picturesque rock country

SAN FRANCISCO MOUNTAINS, ARIZONA, WITH MOUNTAIN MEADOW AND TYPICAL PINE FOREST

imaginable, the celebrated Garden of the Gods in Colorado being an insignificant imitation only. The manifold, curious, wind-carved shapes of the red sandstone rocks rising abruptly from the ground, contrasted with the green of the surrounding plain, are worth a long journey to see. The few who have visited this secluded valley will also not forget the remarkable bouquet and aroma of the grape, raised by one of the more enterprising ranchers on these sun-warmed sand bottoms, which promises some day to outrank the finest vintage of Bordeaux.

Presently a wide view opens before our eyes; far below us stretches Verde valley, and we are looking over the rim into the borderland of the southern desert region. In red and white and yellow and brown tints glare the arid gravels, studded thinly with a scant, shrubby vegetation, dry and gray. The fresh, bright green spots that catch the eye we find afterward to be groups of opuntias, large prickly pears, whose red, acid fruit we appreciate later in the season, after we have learned how to avoid the prickles which almost invisibly cover them in small tufts. Among the trees, the first we meet is a peculiar, leafless, shrub-like form, with long, slender, green branches, the falsely so-called paloverde, *Cnotia holacantha* of the botanists. The majority of the shrubs of the brush desert belong to the Acacia tribe, all with symmetrically rounded heads, and, like every other plant here, provided with thorns or spines, the peculiar adaptation to desert conditions making the labors of the collector a hard task. Many unfamiliar plant forms excite the curiosity of the new-comer.

We have suddenly dropped to the 3,000-foot level, and begin to feel the difference in temperature; the canteen is often called into requisition. By-and-by the heat of the early afternoon sun leads us to wish that camp were near. Uncertain of the road, we ascend one of the glaring, white limestone hills, and lo! what an unexpected sight meets our eye. The contrast is so great that we think a mirage must have risen to mock our heated brain. There lies at our feet, stretching away for several miles, a land of green vegetation, rich and luscious as in the most favored spots of the Alleghanies in early summer, a broad river of foliage, interrupted here and there by fields of alfalfa and corn, with orchards from which the red roofs peep out hospitably. We are looking into the valley of Beaver creek, one of the affluents of Rio Verde, which, like all these water-courses, hidden away under a dense cover of deciduous trees, are the surprises of the deserts through which they flow, and furnish the water for the irrigated fields of the rancher.

Here we find not only the cottonwoods, hackberry, and ash of several species, as along the streams of the more eastern plains, but a tree alder of excellent shape, peculiar to Arizona, and a plane or sycamore much more striking and beautiful in its foliage than those which are planted in our eastern streets and parks. There is the same tangle of luxuriant vegetation, with grapevines trailing over bushes and trees, that we find in the bottom lands of our Gulf states, with rock and debris and driftwood and sand carried by the flood waters of the stream which comes from the pine plateau—the forest watering the plain. Down in this bower of green, a real paradise after the weary desert ride, we gladly camp and enjoy a refreshing bath in the soda springs.

In addition to the creek and these interesting soda springs, there is a still more remarkable sheet of water to be found in the well-known Montezuma well, a deep hole in the limestone hills, probably originally a large limestone cave, the roof of which fell in when the water collected in it. Here also we find reminders of the cliff-dwellers, who, a thousand years ago or more, built their abodes in the walls of this huge well and used its never-failing water, which passes through a subterranean tunnel into the creek, to irrigate their fields, as do the ranchers of today. Not only the line of the ancient ditch has been found clearly defined, but the petrified ditch itself has been dug out, the lime of the water having completely filled the original ditch with its deposit.

A thrifty agricultural population, with whom agriculture, and especially horticulture, evidently pays, has now taken the place of these prehistoric tillers of the soil, who have left the signs of their existence and their activity everywhere through the territory in more or less preserved ruins, the largest and most elaborate of which, named Montezuma castle, probably because of its size and elaborateness, is found not many miles from Montezuma well. Little is known of these prehistoric people, but after seeing the present abodes and ways of the Hopi and Zuñi Indians, there remains but little doubt in our minds that the ancients were the ancestors of these natives, perhaps not so many centuries removed; and observing that these cliff-dwellings are as a rule situated near or overlooking agriculturally available grounds, and recalling the history of the Apache raids, we conclude that they were agricultural Indians driven to construct their dwellings in inaccessible places for defense against their enemies.

Resuming our journey, a few miles bring us to Verde—the abandoned military post known as Camp Verde—where 2,000 of

the wild Apache surrendered to General Crook in 1883, then and there breaking the war spirit of the race which had harassed for centuries peaceful Indians and white settlers alike. Except in the irrigated valley, everything looks brown and sear and uncompromising under the July sun.* The cattle industry used to thrive in this valley, as in many others of the territory, and also on the plateau; but, just like lumbering in other regions, it was carried on recklessly, the natural meadows being overstocked far beyond their capacity; so that large areas which twelve years ago were luxuriant grass-producers are now absolutely barren, with not a spear of grass visible.

The broad valley of Rio Verde, which carries the drainage from the plateau to Salt river, is capable of agricultural development to a much greater extent than has been attempted; but, as in other parts of the territory, this requires systematic storage and utilization of the water. By careful management the cattle, sheep, and goat industry would no doubt be able to use advantageously the large nonirrigable areas. The home market for this secluded valley is mainly in Jerome, which is the seat of one of the largest copper mines and reduction works in the United States, with an annual output of about one million dollars in value. Prescott and the mining districts surrounding it are also within reach by a long day's ride.

There is hardly a drearier ride to be imagined than that from Verde valley over the Black Hills to Prescott. Up and down hill, over dry ridges studded with chaparral, scrub oak, manzanita, and the like, we traverse a region for which, but for the mineral wealth that may be under ground, no use suggests itself. Arriving at Prescott, we reach once more the altitude of the pines in Bradshaw mountains; but we find that there is little timber left, the town and the mining districts surrounding it having used up most of it. Prescott was once the capital of the territory and is still the metropolis of central Arizona, the supply-base of many outlying mining districts and the cattle ranches in the large valleys on the north and west.

Here we may take train for the southern portion of the territory. A branch road starts from Ash Fork on the Atlantic and Pacific railroad, whence it passes through the Black forest—not of spruces, firs, and pines, like the celebrated forest of that name

* When we passed this way again, in September, after the rains had had opportunity to be effective, the country was almost unrecognizable; the dry, brush desert had changed into a beautiful prairie, and for the first time in eight years the grass had grown large enough to be cut for hay.

in Germany, but of somber, low-topped cedars and piñon—the road running over trestles and loops to get from the plateau into the valley. Passing southward from Prescott on this line, we traverse a rugged, dry, mountain country, which contains rich mining ground where a man may wash his day's wages in gold from the soil anywhere in the creek bottoms or cañons. Deficiency of water alone retards this mining development; yet some large mines are worked by pumping water six and eight miles over the mountain.

As we descend into the plain from the 6,000-foot level of Prescott the temperature seemingly rises in geometric ratio, and as we reach the plain, at about 1,200 feet, we begin to suspect our friends were right after all in commiserating our fate. We reach Phœnix at night, and the broad waters of Salt river in the moonlight at least suggest coolness, and the night, warm enough to sleep outdoors, does indeed afford relief from the excessive heat of the day, when the thermometer was at 110°.

The southern portion of Arizona can be subdivided into two sections fairly well differentiated topographically, climatically, and economically. The eastern district is elevated and mountainous; it is bounded on the west by the high mountain ranges of Santa Rita, El Rincon, Santa Catalina, and Tortilla and Superstition mountains. The western part is a vast desert plain out of which, like islands from the sea, rise abruptly, in parallel lines ten to thirty miles apart, in black and purplish hues, rugged and towering granite mountains, reflecting the sun's rays with dazzling brilliancy. These mountains are mostly devoid of vegetation and mostly also of soil, awful in their barrenness, while the desert below may be just as barren in places or else is studded with the sparse vegetation of cacti, agave, yucca, catsclaws, paloverde, mesquite, etc.—a paradise of spines and thorns. There would appear on general principles nothing more depressing than such a country; so it is when viewed from the car-window; yet, as a matter of fact, to the explorer it is full of interest, a stimulus to the curiosity and furnishing real entertainment; and, finally, much of this hopeless desert promises to the future many a paying enterprise. Not only do the desert mountain ranges contain minerals of value—gold and silver and others—while salt, borax, gypsum, sulphur, asbestos, kaolin, and pumice-stone may be found in the plain, but the soil is capable of producing profusely in this southern clime, if only water can be brought to it. Water is the great problem here. The little rain

that falls over the vast region fills the water-courses, where there are any, for only a few hours, after which what is not evaporated sinks into the loose sand and the river continues underground, the bed above "running dry." Yet, as to the possibility of finding enough water to irrigate the most of it, who will foretell?

There are really only two rivers which run always full—the Colorado and the Gila. While Gila river and its affluents, the San Pedro, Salt, and Hassayampa, which run dry occasionally, furnish only a limited quantity, the mighty Colorado river carries a volume of water not only six times as rich in fertility as that of the Nile, but of almost limitless and continuous supply, which would suffice to irrigate several million acres. To be sure, the bed lies considerably below the level of the plain, yet when the economic conditions of the country require it, there will be no difficulty in devising the mechanical means to bring this water upon the land, as is being done now in a small way at Yuma. And, with the addition of artesian wells, perhaps it may only be a question of time when these dreary wastes will be turned into fertile fields and gardens such as are beginning to grow up around Phœnix, Yuma, and other cities—a revival of bygone times when an ancient and industrious people occupied the Gila bottom lands, of whose existence now only the ruins of long-fallen towns, the remnants of large aqueducts, and widely distributed fragments of pottery testify. Phœnix, the capital, already boasts of being a garden spot, all owing to the extensive irrigation canal system which derives its waters from Salt river, and certainly the green alfalfa fields and extensive orchards of peach and almond, olive and pomegranate, are a most pleasing contrast to the surrounding cheerless brush desert. The city, embowered in the tropic foliage of palms and pepper trees, with its luxurious hotels, is bound to become—nay, has already become—a Mecca of the seeker after a mild winter climate and relief from pulmonary complaints. While its summer temperatures may be said to lack nothing in generosity, for eight months in the year the climate is said to be perfect.

The eastern mountain region is mainly a pasturing region; the valleys are clothed with hardy grass and stunted acacias, while the mountains, when over 6,000 feet high and massive enough to induce precipitation, are wooded; the drier exposures and lower altitudes support an open growth of stubby live-oaks, the trees varying in height from 12 to rarely over 25 feet, which in the distance have the appearance of an old apple orchard.

Higher above the 6,000-foot level and reaching to the tops at 10,000 feet at most, the pines appear, including several most interesting species, which are at home further south in Mexico, together with some of more northern nativity.

In these mountains, within a day's ride from Tucson, we may find the most lovely, cool recesses of a trout-stream either in the Santa Catalina mountains or, with a few hours of railroad added, in the Chiricahua range, where we may readily forget that we are in the dryest and hottest—erroneously so believed—portion of the United States. Here, at the higher elevations among the pines, the air is most delightful, and while the days are just about right, the nights may, even in September, be frosty enough for a double blanket. Tucson being 2,400 feet above sea-level at the eastern border of the desert is the rival of Phœnix; not indeed with regard to agricultural development, for this old presidio of the Spaniard placed there to protect the mission of San Xavier among the Papago Indians, still in existence, lies high and dry beyond sufficient water supplies, unless some time artesian wells may be developed; but it is or will be a rival as a health resort, excelling the capital in the conditions and quality of the air, helpful in pulmonary diseases.

Returning to the plateaus of northern Arizona, there are two trips which we must take together from Flagstaff, for without them a visit to the territory is decidedly incomplete—one to and through the Painted desert to the villages of the Hopi Indians, the other to the Grand Cañon.

Having heard that within three days the celebrated snake dance is to take place at Oraibi, one of the Hopi villages 100 miles northward, we get ready our camp outfit for a plunge into the desert. Once more we skirt the San Francisco mountains, which will remain our guide and landmark through the whole trip, visible at any time and to the last. Once more we pass through the pine forest and over the black lava sands of the juniper and piñon belt, coming out on the rocky limestone plateau, with its scanty pasture and low shrub growth.

Water is scarce on this trip, and although spring wells and so-called tanks—clayey soil depressions and rock cavities in which rain-waters collect—may be found at distances of 25 to 40 miles apart, it is safer to carry water in the approved fashion. We reach the river, the Colorado Chiquito, or Little Colorado, marked in the distance by the line of cottonwoods, on the morn-

ing of the second day, and find its bed, which is usually dry, filled to the brim with a yellow loam puddle, a rushing torrent.

We should have to camp here until the flood abates but for the enterprise of a trader, who has spanned the river with a steel cable by means of which we transfer our packs, swimming our horses. Now we have in truth entered a desert, such as we have met nowhere else in the territory.

The scene is one of utter desolation. Not a tree or a shrub breaks the monotony of the flat table-land; here it is eroded into deep, dark, varicolored green, blue, and yellow-brown ravines and chasms, there overtopped by high mesas with flaming red edges, the sands reflecting the sun's rays in a white and yellow glare, and the white summer clouds in turn reflecting not only the heat but the colors of the desert. In the distance peculiarly shaped purplish peaks and pinnacles and solitary buttes mark the limit of the desert proper and our destination two days hence, while now and then a mirage brings into view a sheet of water so distinct and natural that in spite of our knowledge of the immaterial nature of the apparition our eyes refuse to accept the reasoning of our minds. Now and then we pass over different soils, alkali in nature and still more forbidding than the sand; then again heavy loam soils with scant brush growth. If there ever was a region which would be thought beyond the possibilities of useful occupation, you would think that this was the one; and yet as we reach the trading post of the enterprising German whose cable helped us over the river we are as ready to distrust our eyes believing to see a mirage as when we found ourselves deceived in the phantasmal lakes, but there certainly seem to be green corn-fields. We are not, however, deceived; there is real corn of various kinds, and sugar-cane and potatoes and other garden truck, not less than 40 acres in cultivation right in the sand and without irrigation.

Listen to what the enterprising cultivator writes of his success in the first year's experiment: "Our crop has furnished us 80 tons of hay and fodder; sugar-cane did the best, 8 feet high; corn, the old Indian variety, has done well; watermelons, onions, and sweet potatoes seem to be at home here, and all that without a drop of rain for 18 months. Our trial plantings have fully paid us. Now we have a lake here, made by construction of a mud-dam across a dry wash, and filled by the floods from the upper country, 1 by 1½ miles in extent and 20 feet deep. The reservoir was filled about September 15, and has lowered until now, Jan-

uary 3, hardly 15 inches. Irish potatoes were small, but perhaps would have made good-sized tubers but that they were drowned; yet we caught ducks in return, which we shot from our boat. The cottonwoods planted have done well; expect to plant 10,000 this spring. There are a million acres around me which can do the same."

How is it possible, you ask, without water? It is due to the moisture held in storage from occasional rains and drainage by the sand, whose structure prevents its evaporation as well as its sinking away. Who will foretell the possibilities of the future?

After this experience we are not surprised to find further on the cornfields of the Navajo Indians on the sandiest sites, much more primitive, to be sure, and when we reach the village of Oraibi the thrifty fields, small garden patches, and peach orchards show that these sands and dry deserts can yet support a goodly population.

Here we are at last, after a weary ride over the sand and through the cornfields and bean patches of the Hopi Indians—called Moki by alien tribes in opprobrium and by some whites through objectionable imitation—at the base of a precipitous mesa, perched on which, 300 feet above, stands Oraibi, one of the "Seven Cities of Cibola," where for hundreds, perhaps thousands, of years the original race of Indians have lived peacefully, closely packed in their stone houses. There can be no more picturesque sight than this town, with its inhabitants, clad in blankets of bright colors, grouped on the tops of the gray limestone houses, watching the snake dance, nor is there anything more fascinating than to watch these ceremonies. There is hardly a more promising field for ethnological study than these primitive house-builders and agriculturists, but they are foreign to our chief subject, and we can only glance at a few features in rapid succession.

This has been a festive time, and hence the usual filth has been in part removed and a general house-cleaning and cleaning of hair and body has taken place, so that inspection of the dwellings, which the good-natured children of Nature rather court, is comparatively satisfactory. The wealthier householders have even whitewashed their houses outside and inside, and their stores of corn are in ship-shape order. The ceremonies of the snake dance last nine days in all, partly in public, partly in their secret temples, where, as a rule, only the priests of the two orders—the Antelope and Snake—are admitted. Today is the last day, and the snake dance is the end of the ceremonies, the purport of which is to bring rain for the suffering crops. The Antelope

priests—painted, masked, and decorated—coming from their kiva in single file, perform a rhythmic round march and place themselves on guard before the snake hut made of cottonwood boughs, in which the reptile partners to the dance are placed. The snake priests perform the same round march, and then, placed in rows opposite each other, the two lines begin a low incantation, accompanied by rhythmic motions in unison, sidewise, to and fro.

Weird is their song, weird are their looks, and weird their motions, but weirder still all these when their wriggling, writhing partners enter the circle and the round march with the snakes begins. For this the snake priests divide into sets of three, the carrier holding the reptile, venomous or not, and in full possession of its fangs, between his teeth, and rhythmically swinging its curling body, the charmer following him, with eagle feathers stroking the hair and shoulder of the carrier or else his burden, while the catcher trips on the outside, ready to pick up with unfailing accuracy the reptile. When it has done its service it is laid on the ground and darts away for liberty. The dexterity with which this act is performed, the man taking time to first strew the sacred meal and apply the charm of eagle-brush to the escaping rattler, makes the catcher the hero of the hour. When all these 20 or 30 reptiles have thus passed through the rite, it only remains to carry them toward the north, south, east, and west, whence they came, and set them free, unhurt, for they are the personified spirits of ancestors, who have in the ceremony been induced to intercede with the deities.

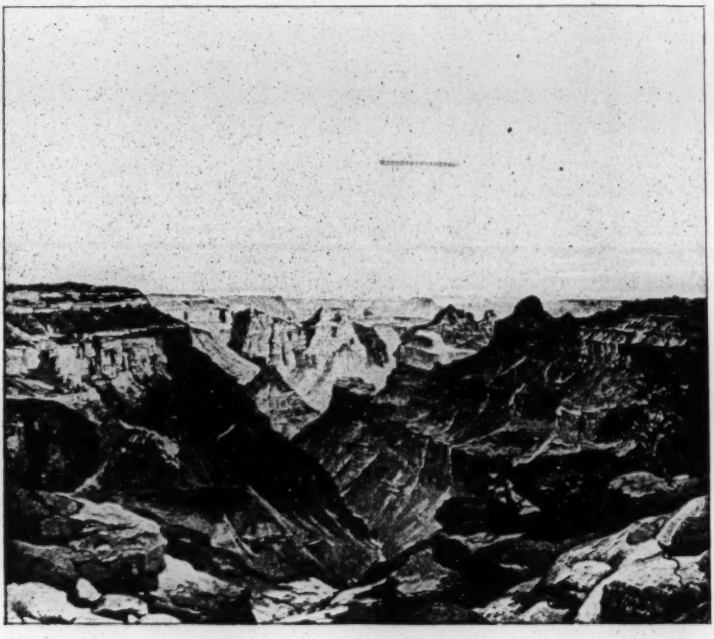
The result of the prayer for rain, which is the purport of the whole ceremony, seemed to follow immediately in a most tremendous downpour, which turned the dry wash at which we are encamped into a raging torrent 60 feet wide and 5 feet deep. This result, however, was promptly disclaimed by the snake priests, for their prayer is for gentle rain—a drizzle, as it were—which they rarely get.

But we must hurry away for our last trip, the one by which we shall always remember Arizona if all else be forgotten—the Grand Cañon of the Colorado.

A flying stage from Flagstaff brings us in a long day's ride, yet not a dreary one, through the pine woods past San Francisco mountain, again through the cedars, over open mesas and through pine woods once more to a neat tent city—a hotel establishment well fitted to its surroundings and well kept—nestled in a depression among the stately pines close to the cañon. We are within

a hundred steps of the object of our visit, but there is no indication of its presence; nothing but commonplace landscapes, albeit in the lovely setting of the shady pine boughs. We ascend the slope, unsuspecting what it is that makes people who have seen it so unreasonably effusive when speaking of it; and then suddenly the sight bursts upon us; the earth has sunk away at our feet to illimitable depths.

The first sensation is one of awe and bewilderment; a shock, a sense of oppression, perhaps of horror, overpowers you. There



is nothing you have seen before that has given you even a hint of what this is; nothing you can compare it to. It is an innovation in nature which it takes time to comprehend—to appreciate; then as you gaze grows on you a realization of the enormousness, the gorgeousness, the weirdness, the grandeur, majesty, and sublimity of the scene. Speechless you gaze on the vast sea of ghostly, giant shapes, and are overcome by the feeling of your own insignificance as in the presence of infinity. Only gradually are you made fully conscious that you behold the most sublime of all earthly spectacles.

No picture has ever conveyed an idea, language there is none that can ever give an adequate conception of the ensemble of this great chasm—its vast proportions, its intricate plan, the nobility of its architecture, its colossal buttes, its wealth of ornamentation, the splendor of its rich colors. It is not a cañon at all that you see—the word belittles the scene; it is a labyrinth of an infinite number of chasms and cañons that press themselves upon your view all at once, a mighty mountain country filled with most fantastically carved, gigantic, rock masses, cyclopean castles thousands of feet in height, gracefully towering gothic cathedrals, round-topped Moslem mosques, Greek and Indian temples, frowning rock cities, pyramids, and obelisks, battlemented fortresses, all the wonders of the Arabian Nights multiplied and heaped together in a wild chaos, stimulating your fancy beyond its power.

And not only is the ensemble present the most stupendous sight; even the least imposing portions of the cañon are as impressive as any scenery that can be found in the world. For 200 miles of the river bed, with a breadth of 10 to 12 miles and more, is here revealed the interior of the workshop of Nature and the secrets of the building up of our earth's crust. The surrounding plateau country is scored by intricate mazes of side cañons. In these and in the main chasm to a depth of 6,000 to 8,000 feet geological history is exhibited in precipitous walls with a clearness unparalleled in any portion of the world, telling of æons of rock-building and of millenniums of rock-carving by wind and water. Far below, hardly recognizable if at all visible from above, flows the great river, which in its ceaseless rush has carried to the sea the sands and debris, results of the denudation of more recent formations; has cut through the pale gray limestones of the Permian, the pink and brilliant red sandstones and the purplish and vermilion limestones of the Triassic, the deep brown rocks of the Carboniferous, down to the somber, iron-black granites of the Silurian and Archæan ages, through which the river now rolls its yellow waters, gathered from thousands of square miles in the mountains of Colorado and the plateaus of Utah and Arizona—here in placid and majestic dignity, there with a wild current in roaring rapids, over boulders and rocks and precipitous falls.

"Great as is the fame of the Grand Cañon of the Colorado, the half remains to be told," wrote Major Dutton in 1881, in his superb monograph on the cañon; and this is still true today, and will be for many years. While its geology has been unfathomed with considerable detail by that philosophical geologist, we have

but fragmentary knowledge of its flora and fauna, and we have hardly yet dared to think of its undiscovered wealth of minerals and its other economic possibilities.

We arrive at the brink on Sunday night; a thunderstorm has left a deep black nimbus, a dense glowering sheet, in the sky to the east, on which two beacon-lights appear, the bases of an unfinished rainbow, standing straight, like two sentinels, on each rim of the cañon. To the west, the sinking sun paints the horizon in deep crimson, surrounded with a golden glory, each one a cluster of small black clouds, while in the north a wild, yellow hail-cloud casts its lurid glare. It was in this setting that through rising mists in purplish hues the mystery of the cañon, awful in the utter stillness, revealed itself to us—"a thought of God on earth expressed, all meaner thoughts expelling."

Whatever may become of Arizona in the future, it will always be known to the world as the country of the Grand Cañon, the wonderland of the Southwest.

MOUNT ST. HELENS

By Lieut. Charles P. Elliott, U. S. A.

In going by steamer from Portland, Oregon, to Vancouver, Washington, on a clear day it is possible to see from the pilot-house five snow-capped mountains—Hood, Jefferson, Adams, Rainier, and St. Helens. The last mentioned is more to the west than the others, and has the appearance of a regular, inverted cone, truncated and rounded off. The mountain presents this same appearance from all sides when the observer is at any distance. Two seasons spent on this extinct volcano have enabled the writer to get a general idea of the effects of volcanic action on the local geography and to make a topographic map of the district. Since it is within plain view of many prominent points astronomically established, it seems strange that Mt. St. Helens should not be accurately placed on any map which the writer has examined, either as to its own position or relatively as regards the other snow-clad peaks.

Mt. St. Helens lies east of Vancouver Barracks, north of Lewis river, west of the Columbia, and south of the Cowlitz; it is west of the divide of the Cascade range, even more to the west than Mt. Rainier. From rough triangulation based on recent surveys,

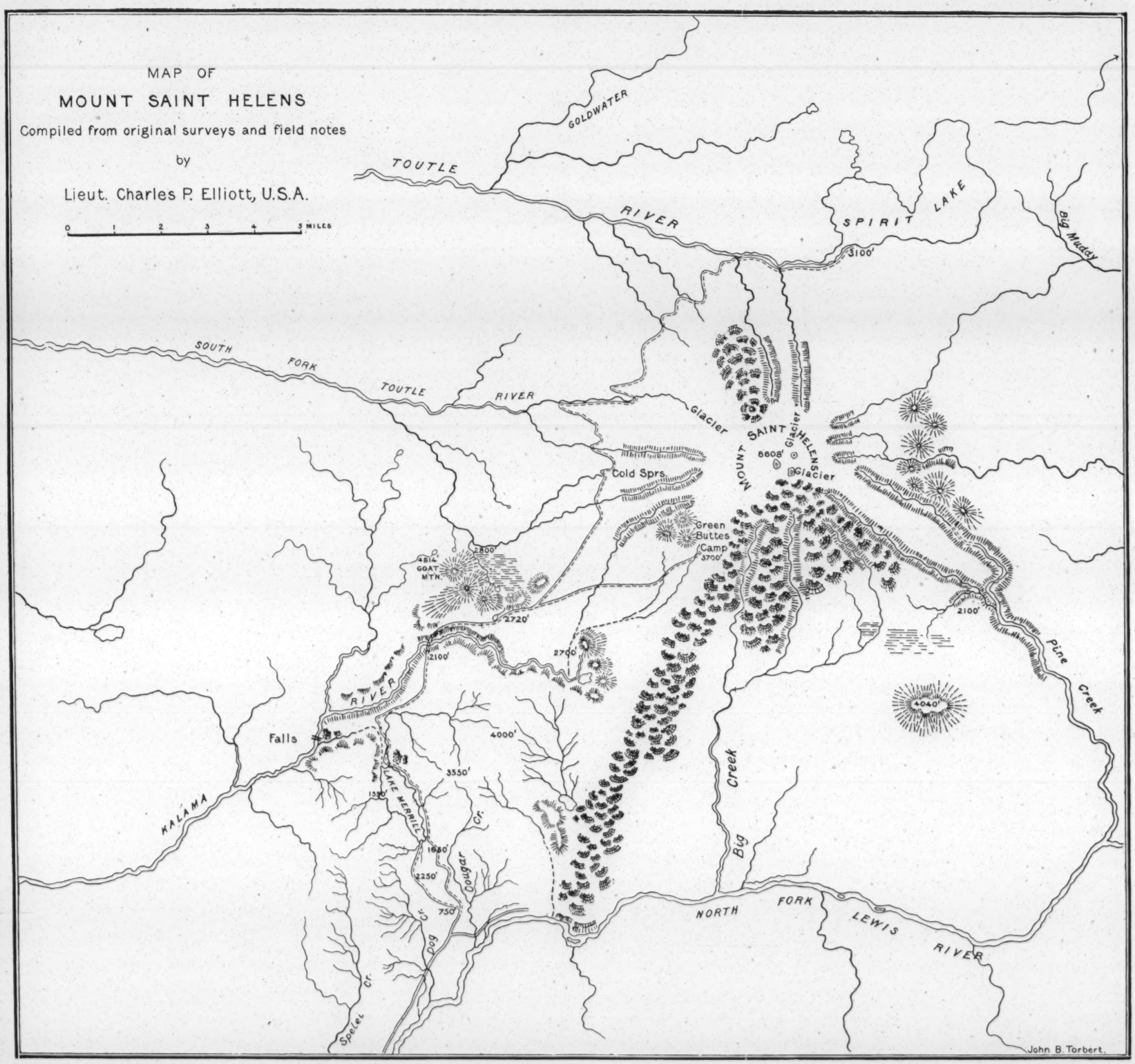
the writer's map shows the summit to be in the northeast corner of township 8 north, range 5 east, of the Willamette meridian, and its altitude taken on a clear, still day, with an excellent aneroid, is 8,608 feet.

The approach to the mountain is by wagon road up the north fork of Lewis river to the foot of the trail to Lake Merrill, around the lake to and across the Kalama river, up the Kalama for a short distance, then toward and by Goat mountain and in a northeasterly direction to what is known as Butte camp, at an elevation of 3,700 feet. From this point horses can be taken to the bench above, but there is no water and but little wood, and Butte camp is the proper place from which to climb the mountain unless you are thoroughly familiar with the very rough country around the base. Formerly the approach was from Lewis river, four miles above the trail to Lake Merrill, and up a continuous run of lava, sloping gradually up from the river, to Butte camp, a rough, hard trail, in many places over broken lava. Mt. St. Helens is not difficult of ascent, and is probably the least dangerous of any of the snow-clad mountains of the Cascade range. In going from Lewis river the trail leads up a steep hill, rising 900 feet in two miles, and then drops down 100 feet, when you most unexpectedly find yourself on the south edge of a small lake about two miles from Lake Merrill, without any apparent reason for its existence. On going to the northern end of the lake you find a mass of lava extending entirely across the axis of what was originally a mild cañon.

There are a few small streams flowing into Lake Merrill, but there is no visible outlet. The difference between high and low water is more than thirty feet. The rainfall in autumn and spring and the snowfall in winter are very great, and the fall in the level of the lake at the close of the spring rains is much too great to be accounted for by evaporation. On a very still day during September, 1895, I searched carefully at the north end of the lake and found in the sandy bottom, about fifty yards from the shore, a deep, funnel-shaped hole, evidently the beginning of the outlet. Further to the north and toward the Kalama river, where the lava flowed over the standing trees (the places of the trunks now forming wells in the lava). running water can be heard, and with a strong cord and bucket drawn up. Still nearer the Kalama a bold stream breaks out of the lava and flows into the river just below a beautiful fall formed by the Kalama flowing over the edge of the same run of lava that

dammed up the waters of Lake Merrill. The space between the lake and river on the north is comparatively level, the lava in many places being covered with soil, and that with a heavy growth of timber. Where the sand and ashes predominate the growth is poor. The flow of lava, volcanic sand, etc., that ends at Lake Merrill and the falls of the Kalama, starts from the west and southwest sides of Mt. St. Helens, flows against the Green Buttes and neighboring hills, almost filling up the space between these elevations and the mountains, passes around the buttes, unites and fills in between Goat mountain and the high ridge northeast of it, forming a swampy meadow at the base of Goat mountain, the waters of which are strongly impregnated with iron, while to the south of the ridge runs a clear, cold stream coming from the lava at Cold Springs and joined by a second stream coming from the snow directly west of the summit. To the south from Green Buttes the country is filled in until checked by a semicircle of hills that turn to the west and extend south of the Kalama river. A small lake fills the level space between the hills. The Kalama river bursts as a full-fledged stream, bubbling up like a fountain from the southwest side of the more northerly hill, flows south to the lake, then turns to the north of west, flowing at first through willows and swampy ground, then gradually gains strength and cuts down in the volcanic sand and boulders on its north bank, the high ridge being to the south. Finally, near where the trail crosses the river, it cuts through the volcanic formation and ends by leaving all the volcanic deposit on the south side, a spur from Goat mountain forming its north bank. When the river tumbles over the falls it leaves the volcanic formation and runs through a growth of fine timber to the Columbia river at the town of Kalama. Except where lava and bed rock are exposed, the country below the level of 5,000 feet is covered with a dense growth of timber and brush.

To the east of the head of Kalama river is a run of lava that starts near the summit of St. Helens and extends with a nearly uniform slope to the north fork of Lewis river. This lava has filled up the country in its course, flowing around hills as a river around islands. About two miles from the river it has crossed the course of a small stream, forming during the wet season a large pond, with an underground outlet sufficient to carry off the flow of the stream during the dry months and the excess, due to rain and snow, after the dry season sets in. The water from the pond and stream finds its way into Lewis river under


MAP OF
MOUNT SAINT HELENS
Compiled from original surveys and field notes
by
Lieut. Charles P. Elliott, U.S.A.
0 1 2 3 4 5 MILES
GOLDWATER
TOUTLE
RIVER
SPIRIT LAKE
Big Muddy
3100'
SOUTH FORK TOUTLE RIVER
Glacier
MOUNT SAINT HELENS
8608'
Glacier
Cold Sprs.
Green Buttes Camp 3700'
4814' GOAT MTN.
2800'
2720'
2100'
2700'
2100'
Pine Creek
4040'
RIVER
Falls
4000'
3550'
1380'
LAKE MERRILL
KALAMA
1680'
2250'
750'
Cougar Cr.
Dog Cr.
Speel Cr.
Big Creek
NORTH FORK LEWIS RIVER
John B. Torbert.

the surface of the lava. East of the lava run is a bold stream with several branches, some coming from the snow and some from a swamp east of south from the mountains. The black lava spreads out like a fan on this side. Where it stops the slopes are covered with boulders, and as the high ground to the south arrests the flow of volcanic sand, etc., and is filled in, a comparatively level swamp is formed, with streams flowing into Big creek on one side and Pine creek on the other. Northeast of the lava and nearly due east of the summit the most considerable glacier on the mountain is found. The glacial stream issuing from it flows through boulders, ashes, pumice-stone, etc., as a dirty stream for about three miles, when it sinks with high banks of volcanic sand on both sides, but soon appears as a clear stream, between very high, white, sand banks, until within a few miles of Lewis river, where the volcanic deposits disappear.

Going to the northeast and across Pine creek you find a succession of buttes that form the watershed between Pine creek and the Big Muddy, and also act as a barrier for the sand and pumice-stone, now very plentiful, that has formed a nearly level and barren plateau between the base of the mountain cone and the tops of the buttes. Two small streams—one clear, the other muddy—run gently over the level and, having joined, pitch over the steep slope and join the Big Muddy. To the north of the hills a third stream flows down from the ice and snow and finds its way also to the Big Muddy. Northeast of the mountain the deposit of sand, ashes, and pumice-stone is greater than on any other side. This deposit, passing to the north and keeping west of the high ground of the original formation, has formed a dam across a cañon, and the result has been Spirit lake, a deep and quite considerable body of water. The outlet over the dam is known as Toutle river. Following down Toutle river from the lake, the flow at first is very gentle, then a shallow pond is formed about a quarter of a mile long, and below that the stream gets more rapid, but remains clear until about two miles below the lake, where a muddy stream comes in from the mountain. One mile further down a second stream comes in from near the base of the mountain. Leaving the river on what is called the Spirit Lake trail, through dense underbrush and pine thickets, you pass below the lower edge of a run of lava from the northeast side of the mountain and across a swamp, formed as before by volcanic agencies; also across two small streams, from springs below the lava, and climbing steadily up, over ground covered

with boulders and heavy timber, the edge of the cañon of the South Toutle is reached. The north side of the cañon is of fine white sand, and is very steep and hard to climb. The South Toutle flows from under a glacier in plain view, and runs in a bed of boulders directly toward the point where the trail first strikes the edge of the cañon, then turns more to the west and with a constantly widening bed of sand and rocks, filling the original cañon to a width of a half mile or more, the stream flows sometimes on one side, sometimes on the other. The water occasionally forms a dam in one of its temporary beds among the rocks, and having gathered sufficient head, bursts the dam and comes down, bringing large boulders with it. After leaving the South Toutle and passing over high ground a second and smaller cañon is crossed, with a bold stream running from the mountain into South Toutle, then up to a high bench and down to Cold Springs, which crops out under the lava and flows toward Goat mountain and finally into Toutle river.

The circuit of the mountain on the lower levels is now complete. At the summit of the mountain the highest point is bare rock. South of east and also north of east are two other bare points; the intervening space is covered with snow, and between the two easterly points the largest glacier issues, from which Pine creek runs. Almost directly north of the head of this glacier and across the northern point of rocks the second glacier begins, the water from it flowing into the North Toutle, and northwest of the highest point is the third glacier, the source of the South Toutle.

Snow falls to a great depth over all this country in winter, but in early summer the warm rains and hot sun melt the snow very rapidly and the black lava on the mountain, to its very summit, is exposed in streaks radiating from a common center.

GEOGRAPHIC LITERATURE

Magnetic Declination in the United States. By Henry Gannett. From the Seventeenth Annual Report of the U. S. Geological Survey. Washington, 1896. Pp. 203-440, with map of the United States showing the lines of equal magnetic declination for the year 1900.

This memoir of 237 pages sets forth and discusses the data used in making the magnetic map which accompanies it. This map, whereon the curves of equal declination or isogonic lines for the year 1900 are shown,

is about 18 by 28 inches in size, and is printed in four colors: black for projection lines, names, and all cultural features; blue for streams; green for the oceans and large lakes, and brown for the hill and mountain features. These relief features are shown by contour lines. The contour interval, from 2,000 feet upward, is 1,000 feet. Below the 2,000-foot contour the interval is variable. Over this base map the magnetic curves are printed in red.

The magnetic declination, popularly called variation of the compass, is subject to several known periodic changes. Of these the most important is the secular change—a change with a period running through centuries; hence its name. As this secular change is progressive from year to year for long periods, and as it amounts in the United States to from 2′ to 5′ per year, it is for the surveyor and mariner the most important of the periodic changes. Indeed, it is the only one of much practical importance at present. It is to this practically important quantity that Mr Gannett has wisely devoted the greater part of the labor expended on this memoir. The weakness of similar maps hitherto produced has been recognized by both their makers and users to be largely due to defective knowledge of the secular change.

Of the 237 pages comprised in the memoir 82 are devoted to *data for secular change*. A table of results by counties occupies 135 pages, while the remaining 20 pages are given to introductory matter, discussion, statement of sources of data, etc.

The sources of the data are the Coast Survey, Lake Survey, the Wheeler, Hayden, and Powell Surveys, New York State Survey, New Jersey Geological Survey, Boundary Surveys, United States Corps of Engineers, Army Exploring Expedition, National Academy of Sciences, and others; but it is chiefly from the records of the United States General Land Office and from county surveyors that a vast quantity of hitherto unused material has been derived. Indeed, so abundant are data in the General Land Office that it was only needful to select for the older "land office" States such as were desired. The mass is much greater than is needed to produce a map sufficient for all practical needs. As to this Mr Gannett says:

"I have not attempted to make a complete collection of this material. The amount is too vast to make it worth while. I have, however, collected all the observations which appear upon the plats of exteriors and standard lines (the Land Office requires that in the survey of all standard and exterior lines the declination be observed), supplementing them wherever needed by observations made in connection with the subdivision of townships. Altogether, I have abstracted from the plats of the General Land Office nearly 20,000 observations, and these form, perhaps, nine-tenths of the material herewith presented."

As the work of subdivision and accompanying magnetic observations began a century ago, it is obvious that these Land Office records constitute a veritable storehouse of information on secular change—a storehouse of which Mr Gannett is the first to make general use.

In addition to these data a circular was sent to all the county surveyors in the United States, and from the returns much valuable information was obtained.

As the accuracy of the material from the Land Office and county surveyors is not of the highest, the adopted mode of reduction was not the most accurate. The graphic methods used were rapid and sufficiently accurate for the purpose, which was to present in the form of a map and the form of a table the best knowledge available as to the magnetic declination in the year 1900. The work was planned and executed as a practical matter and chiefly for the use of surveyors.

The only wonder is that the great stock of data in the General Land Office has not been hitherto made use of. Now that it has been, perhaps some of the colleges and universities in the land office States may be stimulated to undertake a similar work for their own States, going over all the data and supplementing them by observations where such are found to be desirable. M. B.

Carpenter's Geographical Reader. Asia. By Frank G. Carpenter. Pp. 304, with maps and illustrations. New York: American Book Co., 1897.

This little book treats of the various countries of Asia, mainly with relation to the occupations, social customs, amusements, etc., of their inhabitants. Being derived in the main from personal observation and experience, its descriptions are vivid and characteristic, with plenty of local color. H. G.

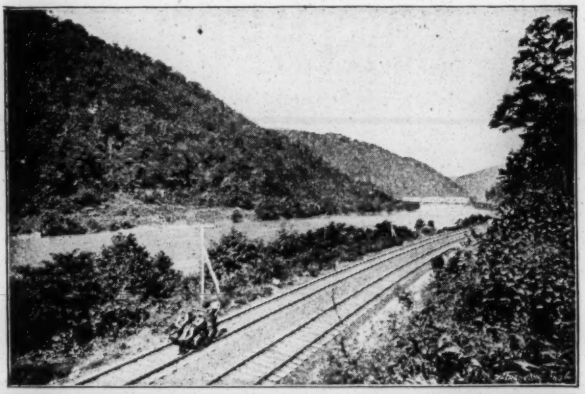
Studies in Indiana Geography. Edited by Charles Redway Dryer, M. A., M. D., Professor of Geography in The Indiana State Normal School. First series. Pp. 113, quarto. Terre Haute, Indiana: The Inland Publishing Company. 1897. 50 cents.

This is a geographic reader, treating of local geography, shaped on the lines of modern science. The dedication to Professor William M. Davis is an index to the character of the book. The opening chapter, entitled "The New Geography," is a most excellent statement of what geography should be. The general physical geography of the State is given in broad outlines, clearly and simply. The topography of the State being largely the result of glacial deposition, this subject receives considerable attention under the chapter headings "The Glacial Deposits of Indiana" and "The Morainal Lakes of Indiana." The natural resources of the State—coal, gas, petroleum, soils, building stone, clays, etc.—receive a chapter. An interesting subject, only too briefly treated, is the changes which have taken place in the surface of the State during the period of white occupation. As a specimen of what might be done for all our great cities, the book contains "A Study of the City of Terre Haute." This consists of a number of questions intended to draw out from schoolboys a full account of the origin, history, location, mode of government, municipal improvements, and social condition of the city. It is exhaustive, extremely suggestive, and altogether admirable. The book closes with a history of the Great Lakes, which seems rather out of place in this connection.

The maps in the book are by no means in keeping with the quality of the text, being crudely drawn and poorly executed.

The work as a whole is a most valuable addition to the teaching of geography, and its influence will be felt not only in the State of Indiana, but elsewhere. H. G.

C&O ROUTE



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S ..... W .....

HAND	COMPASS WHIST SCORE	COMPASS WHIST TOTALS	COMPASS WHIST TRUMP	COMPASS WHIST OPPONENTS	HAND
	DUPLICATE WHIST SCORE	DUPLICATE WHIST GAIN	DUPLICATE WHIST TRUMP	DUPLICATE WHIST GAIN / SCORE	
1					1
2					2
3					3
4					4
5					5
6					6
7					7
8					8
9					9
10					10
11					11
12					12
13					13
14					14
15					15
16					16
17					17
18					18
19					19
20					20
21					21
22					22
23					23
24					24
TOTALS					TOTALS

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